

What is claimed is:

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1. A method of driving a liquid crystal display device,
said liquid crystal display device including:

an orientation film over a substrate; and

5 a liquid crystal material over orientation film, said liquid crystal material
having a chiral smectic C_R phase and being continuously switched according to an electric
field applied thereto,

said method comprising the steps of:

displaying a black level by the liquid crystal material in a first period;

10 applying a voltage to the liquid crystal material for a gradation display in
a second period,

wherein the second period comes before or after the first period.

2. A method of driving a liquid crystal display device,
said liquid crystal display device including:

15 an orientation film over a substrate; and

a liquid crystal material over the orientation film, said liquid crystal
material having a chiral smectic C_R phase and being continuously switched according to
an electric field applied thereto,

said method comprising the steps of:

20 canceling out a spontaneous polarization of the liquid crystal material in
a first period; and

applying a voltage to the liquid crystal material for a gradation display in
a second period,

wherein the second period comes before or after the first period.

3. A method of driving a liquid crystal display device:

said liquid crystal display device including:

an orientation film over a substrate; and

a liquid crystal material over the orientation film, said liquid crystal

5 material having a chiral smectic C_R phase and being continuously switched according to an electric field applied thereto,

said method comprising the steps of:

applying a voltage of 0V to the liquid crystal material; and

applying a voltage to the liquid crystal material for a gradation display in

10 a second period,

wherein the second period comes before or after the first period.

4. A method according to claim 1,

wherein a plurality of active elements are formed over the substrate.

5. A method according to claim 4,

15 wherein each of the plurality of active elements applies a voltage to the liquid crystal material, and

wherein the voltage has an upper limit.

6. A method according to claim 5,

wherein the upper limit of the voltage has an absolute value of 7 V or less.

20 7. A method according to claim 1,

wherein a spontaneous polarization of the liquid crystal material is 40 nC/cm^2 - 150 nC/cm^2 , and

wherein a thickness of the orientation film is 15 nm - 75 nm.

8. A method according to claim 1,
wherein a spontaneous polarization of the liquid crystal material is 20 nC/cm^2 - 40 nC/cm^2 , and
wherein a thickness of the orientation film is 30 nm - 150 nm .

5 9. A method according to claim 1,
wherein a spontaneous polarization of the liquid crystal material is 40 nC/cm^2 or less.

10 10. A method according to claim 1,
wherein a first response time is defined as a response time of the liquid crystal material between a first voltage and a second voltage having an opposite polarity to the first voltage not via a voltage of 0V ,

wherein a second response time is defined as a response time of the liquid crystal material between a first voltage and a second voltage having an opposite polarity to the first voltage via the voltage of 0V ,

15 wherein the second response time is five times or more as short as the first response time.

11. A method according to claim 4,
wherein each of the plurality of active elements is connected in series to an auxiliary capacitor.

20 12. A method of driving a liquid crystal display device,
said liquid crystal display device including:
a plurality of thin film transistors being provided over a substrate;
an auxiliary capacitor being connected in series to each of the plurality

of thin film transistors;

an orientation film over each of the plurality of thin film transistors; and

a liquid crystal material over the orientation film, said liquid crystal material having a spontaneous polarization and being continuously switched according to an electric field applied thereto,

said method comprising the steps of:

applying a voltage of 0V to the liquid crystal material in a first period;

and

performing a gradation display in a second period,

wherein the second period comes before or after the first period.

13. A method according to claim 12,

wherein a transmittance of the liquid crystal material is uniquely determined when voltages having a same absolute value and opposite polarities are applied thereto.

14. A method according to claim 12,

wherein the liquid crystal material has a same tilt angle when voltages having a same absolute value and opposite polarities are applied thereto.

15. A method according to claim 12,

wherein the liquid crystal material has a chiral smectic C_R phase.

16. A method according to claim 1,

wherein a spontaneous polarization of the liquid crystal is 100 nC/cm^2 or less,

and

wherein the thickness of the orientation film is 75 nm or less.

17. A method according to claim 2,
wherein a plurality of active elements are formed over the substrate.

18. A method according to claim 17,
wherein each of the plurality of active elements applies a voltage to the liquid
5 crystal material, and
wherein the voltage has an upper limit.

19. A method according to claim 18,
wherein the upper limit of the voltage has an absolute value of 7 V or less.

20. A method according to claim 2,
10 wherein the spontaneous polarization of the liquid crystal material is 40
nC/cm² - 150 nC/cm², and
wherein a thickness of the orientation film is 15 nm - 75 nm.

21. A method according to claim 2,
wherein the spontaneous polarization of the liquid crystal material is 20
15 nC/cm² - 40 nC/cm², and
wherein a thickness of the orientation film is 30 nm - 150 nm.

22. A method according to claim 2,
wherein the spontaneous polarization of the liquid crystal material is 40
nC/cm² or less.

20 23. A method according to claim 2,
wherein a first response time is defined as a response time of the liquid crystal

material between a first voltage and a second voltage having an opposite polarity to the first voltage not via a voltage of 0V,

wherein a second response time is defined as a response time of the liquid crystal material between a first voltage and a second voltage having an opposite polarity to the first voltage via the voltage of 0V,

wherein the second response time is five times or more as short as the first response time.

24. A method according to claim 17,

wherein each of the plurality of active elements is connected in series to an auxiliary capacitor.

25. A method according to claim 2,

wherein the spontaneous polarization of the liquid crystal is 100 nC/cm² or less, and

wherein the thickness of the orientation film is 75 nm or less.

26. A method according to claim 3,

wherein a plurality of active elements are formed over the substrate.

27. A method according to claim 26,

wherein each of the plurality of active elements applies a voltage to the liquid crystal material, and

wherein the voltage has an upper limit.

28. A method according to claim 27,

wherein the upper limit of the voltage has an absolute value of 7 V or less.

29. A method according to claim 3,
wherein a spontaneous polarization of the liquid crystal material is 40 nC/cm^2 -
150 nC/cm^2 , and
wherein a thickness of the orientation film is 15 nm - 75 nm.

5 30. A method according to claim 3,
wherein a spontaneous polarization of the liquid crystal material is 20 nC/cm^2 -
40 nC/cm^2 , and
wherein a thickness of the orientation film is 30 nm - 150 nm.

31. A method according to claim 3,
10 wherein a spontaneous polarization of the liquid crystal material is 40 nC/cm^2
or less.

32. A method according to claim 3,
wherein a first response time is defined as a response time of the liquid crystal
material between a first voltage and a second voltage having an opposite polarity to the
15 first voltage not via the voltage of 0V,
wherein a second response time is defined as a response time of the liquid
crystal material between a first voltage and a second voltage having an opposite polarity
to the first voltage via the voltage of 0V,

20 wherein the second response time is five times or more as short as the first
response time.

33. A method according to claim 26,
wherein each of the plurality of active elements is connected in series to an
auxiliary capacitor.

According to classical electrodynamics, the spontaneous polarization of a ferroelectric material is proportional to the thickness of the film.

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